PR-16. INFLUENCE OF VARIOUS REDUCING AGENTS ON THE STABILITY OF AQUEOUS SOLUTIONS OF SELENOUREA

L. N. Maskaeva[1, 2], V. F. Markov[1, 2], V. M. Iurk[1], M. S. Rogovoy[1]

[1] Ural Federal University of the first President of Russia B. N. Yeltsin,
Mira St., 19, Yekaterinburg, 620002, Russia

[2] Chair of chemistry and burning processes, Ural institute GPS
of the Ministry of Emergency Measures of Russia,
Mira St., 22, Yekaterinburg, 620022, Russia

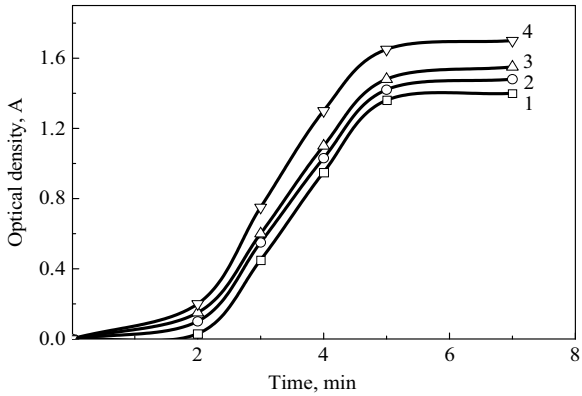
E-mail: l.n.maskaeva@urfu.ru

Selenourea is used today as a selenium precursor for chemical bath deposition of metal selenide. Analysis of different publication revealed that selenide metals synthesized with the participation of selenourea have better properties than materials synthesized using other sources of selenium [1–3]. However the process of selenourea oxidation hasn't been studied yet. It's very important to understand inhibition of this reaction because particles of elemental selenium can be introduced into synthesizable material and decrease their properties. Therefore in this study we have investigated the process selenourea oxidation and determined the better reduce agent for it.

The reaction of selenourea oxidation by oxygen can be described as follows:

$$(NH_2)_2CSe + ½O_2 \rightarrow Se + H_2CN_2 + H_2O.$$

Oxidation of selenourea in aqueous solution has been studied using the UNICO 2408 spectrophotometer. The initial solution is colourless, but it turns red during the reaction due to formation of colloidal elemental selenium. Figure 1 shows changes of optical density of selenourea solution during the time. The S-shaped curve indicates the presence of an induction period of reaction which continues about two minutes. Also selenourea oxidation is autocatalytic reaction. The reaction rate increases with formation of Se.



Kinetic curves of selenourea oxidation at various concentration of selenourea:
1 – 0,001 M; *2* – 0,01 M; *3* – 0,05 M; *4* – 0,1 M

The rate of oxidation increases at pH > 7. It takes more slowly in an acid medium. The study of inhibition of selenourea oxidation has indicated that sodium sulfite Na_2SO_3, ascorbic acid $C_6H_8O_6$ and tin chloride (II) $SnCl_2$ can be used as a reducing agent of it. The mixture of two reducer included Na_2SO_3 and $C_6H_8O_6$ is more effective in different medium of solutions than others.

References

1. Hydrochemical synthesis, structure, semiconductor properties of films of substitutional $Pb_{1-x}Sn_xSe$ solid solutions / V. F. Markov [et al.] // Thin Solid Films. Elsevier. 2012. Vol. 520, № 16. P. 5227–5231.

2. Low-Temperature Synthesis of Oil-Soluble CdSe, CdS, and CdSe/CdS Core-Shell Nanocrystals by Using Various Water-Soluble Anion Precursors / D. Pan [et al.] // J. Phys. Chem. C. American Chemical Society. 2007. Vol. 111, № 15. P. 5661–5666.

3. *Kukunuri S.*, *Krishnan M. R.*, *Sampath S.* The effect of structural dimensionality on the electrocatalytic properties of the nickel selenide phase // Phys. Chem. Chem. Phys. The Royal Society of Chemistry. 2015. Vol. 17, № 36. P. 23448–23459.